INNOVATION – THE ACCEPTANCE OF NOVEL FOOD TECHNOLOGIES BY UNIVERSITY STUDENTS

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ABSTRACT

The aim of the study was to examine the attitude of Hungarian students toward novel food processing technologies. A questionnaire survey was made with sample N=212. Three novel (PEF - pulsed electric field, HPP - high pressure processing and nanotechnology) and two traditional (pasteurization, fortification) technologies were studied. The respondents got a technical definition of these technologies. Based on the description, the respondents evaluated three statements (whether the technologies were extremely good or extremely bad, unreasonable or reasonable and how much do they agree with or oppose the use of these technologies) on a 1-7 point Likert scale.
According to the results respondents have the most positive attitude toward HPP and pasteurization and accept the nanotechnology the least. The rationality of the technologies got the highest scores but respondents supported the application of the technologies the least. This suggests the negative emotional acceptance of the technologies.
The K-means cluster analysis was used for grouping the respondents. We could define four clusters based on the acceptance of the technologies. The *"Slightly differentiating accepting group"* (N=64) judged the technologies nearly as equal, except nanotechnology. They had the most positive attitude toward fortification of foods. The acceptance of nanotechnology was also the highest within this group. The *"Open for novel technologies group"* (N=37) evaluated all the technologies between 4.0-5.5 except pasteurization, to which the lowest preference level was attached. This group mostly preferred fortification and PEF. The *"Traditional technologies supporting group"* (N=59) opposed nanotechnology the most. The highest preference was attached to the well known fortification and pasteurization. *"Naturalness expecting group"* (N=56) mostly preferred the HPP and pasteurization and they were mainly against fortification and nanotechnology. The considerable differences between the groups were primarily caused by the different judgement of the well-known fortification and the less known nanotechnology.
This study was carried out in the framework of the NovelQ EU FP6 project.

1. INTRODUCTION

The new food processing methods provide several benefits (e.g. longer shelf life, less energy and water use, better preservation of vitamins). However, the benefits of the new technologies could only be realized on the market, if suitable demand comes forward for the products produced by these technologies. This makes the examination of consumer attitudes toward these technologies important. The aim of the study was to examine the attitude of Hungarian students toward novel food processing technologies. This study was carried out in the framework of the NovelQ EU FP6 project, which aims at the investigation of novel minimal processing technologies (HPP and PEF).

2. PREVIOUS STUDIES ON NOVEL TECHNOLOGIES

Several researches were made on the consumer acceptance of novel technologies.

Cardello (2003) examines the opinion of 88 respondents about novel technologies. The respondents were between 18 and 64 years and the study was carried out in the US Army Natick Soldier Center. 41% of the respondents had concern of PEF technology, and 29% had concern of HPP technology. The fewest respondents (18%) felt concern of pasteurization. At Central Food Research Institute in Budapest a conjoint analysis was made to examine the consumer acceptance of apple juices made of novel (HPP and PEF) and traditional technologies (pasteurization, untreated products). The study was made with the involvement of 150 Hungarian and 150 Slovakian respondents. The results showed that respondents mostly preferred untreated juices. From among the technologies respondents accept HPP technology the most and those consumers preferred HPP, who rejected pasteurization (Bánáti et al., 2010). Results of Cardello, (2003) and Deliza et al. (2003, 2005) showed the acceptability of application of HPP, too. A study was carried out with 96 fruit juice consumers in Rio de Janeiro. The aim of the conjoint study was to quantify the impact of package attributes (brand, price, production type, product definition and technology information) on consumer intention to purchase. Technology information had three levels: technology with some explanation; technology without explanation and without information about the technology. The information about the technology applied to the fruit juice production had a significant effect ($p<0.05$) on the consumer intention to purchase. The relative importance of the technology was 11% in the intention of purchase. Information about the benefits of HPP technology had positive contribution on purchase intention, while the information about the technology without additional explanation led to a negative impact on consumer purchase intention (Abadio, 2003). According to Deliza et al. (2003) explanation of the meaning and advantages of high pressure technology may lead to higher product satisfaction and contributing to the market introduction of the juice that was processed with non conventional technologies.

3. METHOD

In our survey three novel (PEF - pulsed electric field, HPP - high pressure processing, nanotechnology) and two traditional (pasteurization, fortification) technologies were studied.

Our survey was made with standardized questionnaires. The respondents were chosen from among the students of four universities in Budapest and near to Budapest. 226 students filled the questionnaires. Respondents evaluated the five technologies on a 1-7 Likert scale. The questions concerned the affective, cognitive and conative aspects of the attitude. Respondents had to evaluate the goodness, reasonableness of the technologies, and the agreement of the application with the technologies. The students had not previous knowledge about the technologies, they got short descriptions, which helped them to evaluate the technologies. The descriptions of the technologies were the following:

- **HPP - High Pressure Processing:** High pressure is a technology that preserves food products and extends shelf life of fresh products through application of pressures. High pressure has limited effects on the fresh characteristics and usually maintains colour, taste, texture and nutritional value without using additives. HPP is using limited energy and water compared to conventional technologies.
- **PEF - Pulsed Electric Filed:** Pulsed Electric Field, a mild processing technology is a method that uses short electric impulses to preserve food products. The application of this technology extends shelf life of fresh products. This processing method operates at room temperature, so food quality and several healthy heat-sensitive vitamins are better preserved in the treated products. Using Pulsed

Electric Field technology saves the energy of heating up and cooling down food products.

- **Nanotechnology:** Nanotechnology deals with the production and utilization of particles <100 nanometres (nm) or even smaller in size. Nanoparticles used as vehicle substances make possible to enhance and adjust the colour, flavour or nutrient content of foodstuffs to meet special consumers or health needs.
- **Fortification:** Fortified foods are food products which in the industrial processing are enriched with substances such as vitamins, minerals, fiber and plant extracts in order to increase the health effects of the conventional, basic product.
- **Pasteurization:** Pasteurization is a process where food products are heated up and subsequently cooled down. This process slows microbial growth in food and extends the shelf life of the product.

4. RESULTS OF THE SURVEY

According to the results, respondents have the most positive attitude toward HPP and pasteurization. The judgement of PEF was better, than fortification concerning all three examined attributes. The most unfavourable technology was nanotechnology. The reasonableness of the technologies got the highest scores but respondents supported the application of the technologies the least. It may indicate the low confidence of consumers and the low purchase intention of the products made of food technologies.

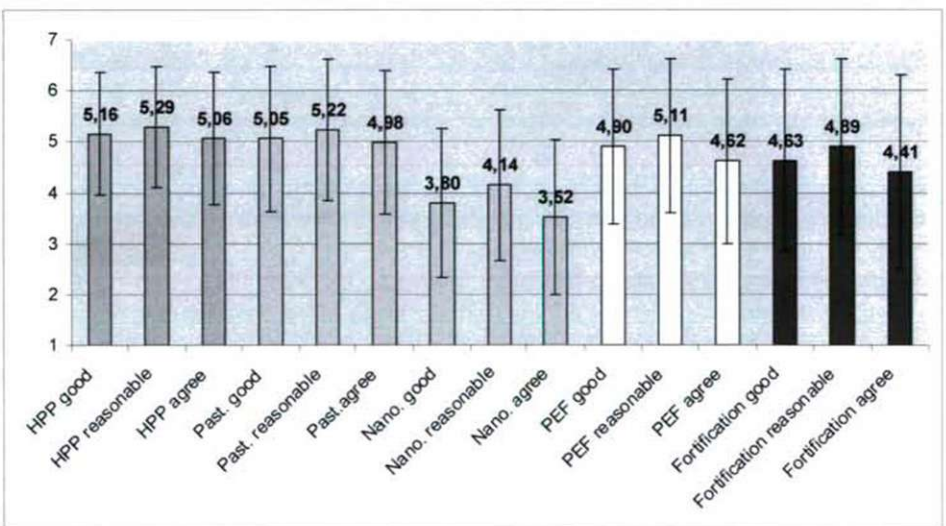

Figure 1. The evaluation of the technologies (N=216)

As the chart (Figure 1.) shows there are relatively high standard deviations, which indicate that consumers are divided in terms of their views of the technologies. For this reason it was needed to examine the separable consumer groups concerning the judgement of the technologies. With the use of K-means cluster analysis four consumer groups were separated.

1. The *"Slightly differentiating accepting group"* (N=64) gave the highest values for all the technologies from among the consumer groups. They judged the technologies nearly as equal, except nanotechnology which got the lowest scores. They had the most positive attitude toward the fortification of foods.

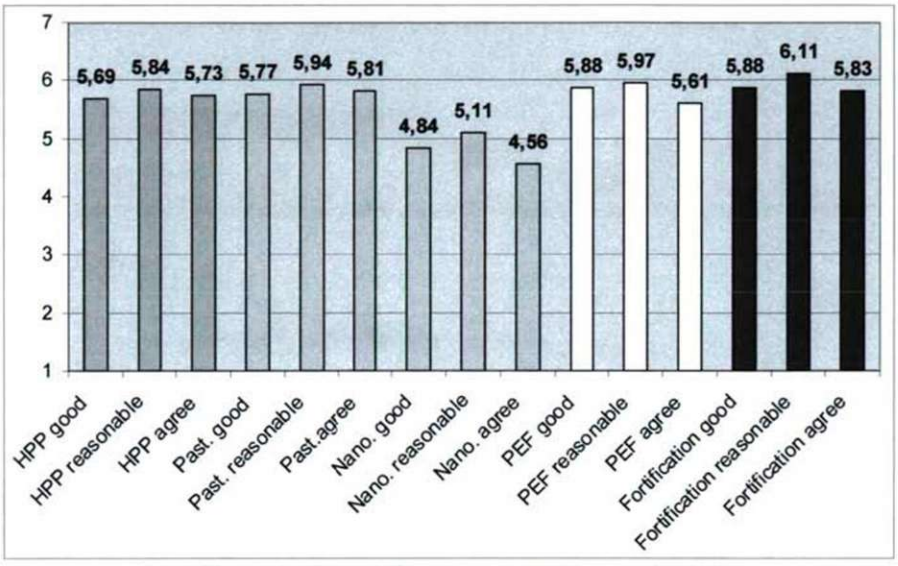

Figure 2. „Slightly differentiating accepting group" (N=64)

2. *The "Open for novel technologies group"* (N=37) evaluated all the technologies rationality between 4.0-5.5 points, except the well-known traditional technology, pasteurization, to which the lowest preference level was attached. This group mostly preferred fortification and PEF. 28 respondents from the 37 are female in this opened group.

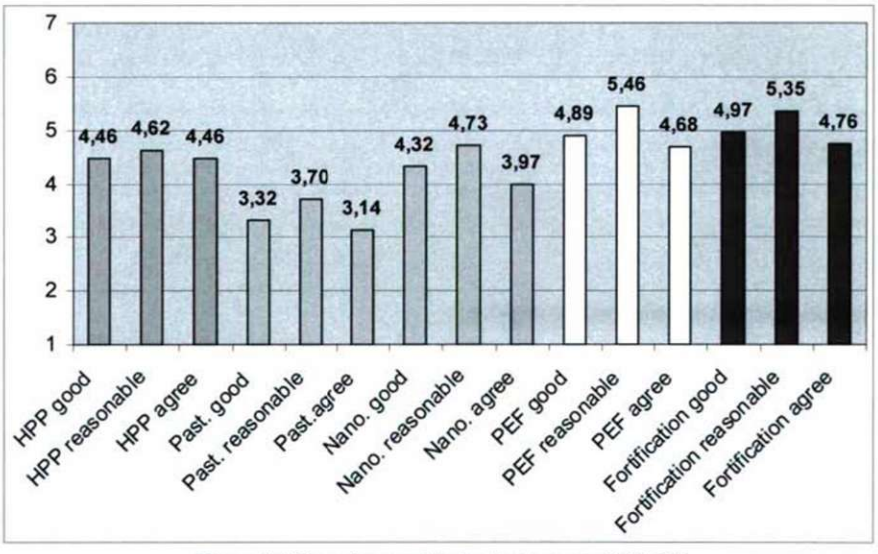

Figure 3. "Open for novel technologies group" (N=37)

3. "Traditional technologies supporting group" (N=59) opposed the nanotechnology mostly. The highest preference was attached to the well known fortification and pasteurization.

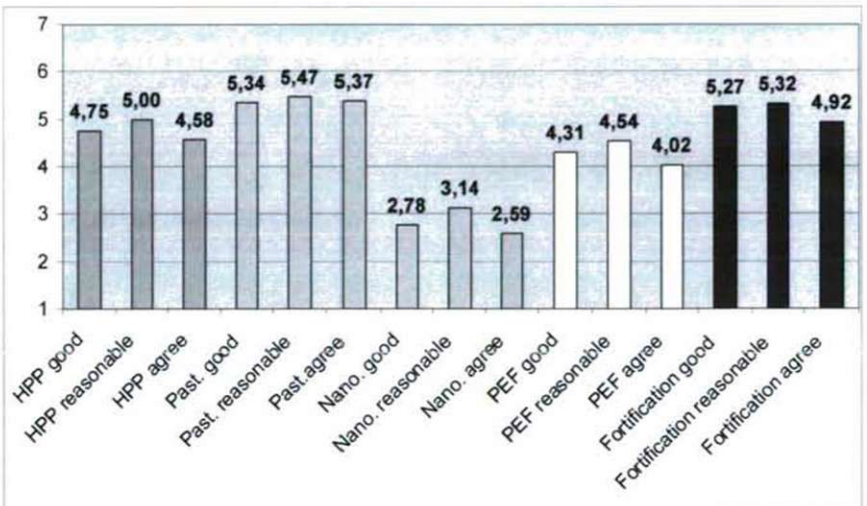

Figure 4. "Traditional technologies supporting group"(N=59)

4. "Naturalness expecting group" (N=56) mostly preferred the HPP and pasteurization and they were mainly against fortification and nanotechnology.

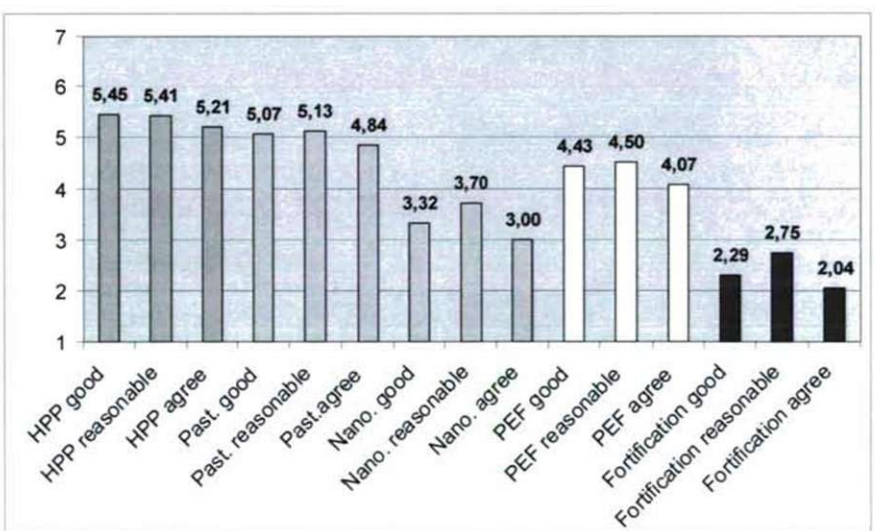

Figure 5. "Naturalness expecting group" (N=56)

5. CONCLUSIONS

30% of the respondents were not influenced dominantly by their previous experiences. Among them, the judgement of the novel and the traditional technologies – except nanotechnology – was approximately similar.

Most of the young adult age group had a strong opinion about the unknown novel technologies. There were remarkable differences in the acceptance of new technologies among the students, which sample was supposed to be open for novelties because of their young age and their experiences.

The *"Open for novel technologies group"* (17%) formed their judgement on the technologies rationally. They preferred physical technologies without heat treatment. 76% of this segment are female.

The judgement of the new technologies fitted to the respondent's existing preferences in case of the *"Traditional technologies supporting group"* (27%) and *"Naturalness expecting group"* (26%). The *"Traditional technologies supporting group"* accepted HPP the most from among the new technologies, presumably because of the favourable associations (freezing, like traditional technology). They rejected nanotechnology, and the acceptance of the PEF was moderate. The most preferred technology among this segment was the well known pasteurization and the fortification.

The *"Naturalness expecting group"* preferred HPP more, than pasteurization. The most rejected technology was the fortification, they judged it unnatural.

According to the survey most of the respondents form their point of view according to their existing expectations and information about the technologies. The results show openness toward novel technologies, particularly the HPP technology. The most unaccepted technology is the nanotechnology.

REFERENCES

1. Abadio, F. D. B. (2003). Effects of pineapple juice (Ananas comosus L. Merr) package information on the consumer behaviour (p.59). Master thesis. Federeal Rural University of Rio the Janeiro, Brazil. IN Deliza, R., Rosenthal A., Abadio, F:B:D:, Silva Carlos H.O., Castillo C. (2005): Application of high pressure technology in the fruit juice processing: benefits perceived by consumers. Journal of Food Engineering 67 (2005) 241-246
2. Bánáti, D., Hámori, J., Szabó E. (2010): Consumer acceptance of minimally processed apple juices- a conjoint study. 15th World Congress and Food Technology. Cape Town 22-26. August 2010.
3. Cardello, Armand V. (2003): Consumer concerns and expectations about novel food processing technologies: effects on product liking. Appetite 40 (2003) 217-233.
4. Deliza, R., Rosenthal A. and Silva A.L.S. (2003): Consumer attitude towards information on non conventional technology. Trends in Food Science & Technology 14 (2003) 43-49